II. REMARKS

1. Claims 1, 2, 4-20, 22-29, 31-35, 37-51 remain in the application. Claims 3, 21, 30, and 36 have been cancelled without prejudice.

2. Applicants appreciate the indication that claims 37-40 are allowed.

3. Applicants appreciate the indication that claims 10, 12, 16-18, 28, 31, 34, and 35 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. However, Applicants believe that these claims are patentable as they stand for the reasons stated below.

4. Applicants respectfully submit that claims 1, 2, 4-9, 11, 13-15, 19, 20, 22-27, 29, 32, 33, 42-50, and 52-57 are not anticipated by Kim (GB 2329090, "Kim").

Kim fails to disclose or suggest performing a filtering operation on the block boundary that is dependent at least in part on an encoding method used to encode an image block on a first side of the block boundary and an encoding method used to encode an image block on a second side of the block boundary, as recited by claims 1 and 19.

Kim also fails to disclose or suggest a video encoder including a filter operating according to block types of a frame in a block boundary environment, where a block type is defined according to a block coding method, as substantially recited by claims 37-40, 44, and 45.

Kim further fails to disclose or suggest performing a filtering operation on the block boundary that is dependent at least in part on an encoding method used to encode an image block on a first side of the block boundary, as recited by claims 46 and 47.

Kim discloses a method for removing so-called "blocking artefacts" that arise in digitally coded video due to the fact that images to be encoded are divided into discrete image blocks which are subsequently encoded independent of each other (GB 2329090, page 2, line 20 to page 3, line 2).

The method disclosed in Kim has two modes of operation, one referred to as "default" mode, the other referred to as "DC offset mode". The passage of text between page 5, lines 3 and 11 describes, at a general level, how a filtering mode (either default or DC offset mode) is selected for a block boundary. In particular, it is stated that selection of the default mode or DC offset mode is performed "based on **an amount of blocking artefacts**" (page 5, lines 5 to 7), the "amount of blocking artefacts" being determined by examination of **pixel value differences within adjacent image blocks and across the boundary between the adjacent image blocks** (page 12, lines 5 to 11 with reference to Figure 2).

It is evident that, according to Kim, the DC offset mode of operation is chosen when the difference in pixel values within / between adjacent blocks is comparatively small, i.e. when it is desired to remove blocking artefacts in a "smooth" region of an image (page 11, lines 5 to 8, page 12, lines 5 to 11). The default mode of operation is chosen in other situations (page 12, line 11).

In contrast, the independent claims of the present application define performing a filtering operation on a block boundary that is "dependent at least in part on **an encoding method** used to encode an image block on a first side of the block boundary and **an encoding method** used to encode an image block on a second side of the block boundary" (e.g. claims 1 & 19) or performing a filtering operation on a block boundary that is "dependent at least in part on **an encoding method** used to encode an image block on a first side of the block boundary" (e.g. claims 46 & 47).

An explanation of the encoding methods (also referred to as block types) used in a typical video encoder is provided on page 2, between lines 21 and 38 of the application text as filed. In the cited passage of text, four encoding methods / block types are described (INTRA, COPY, CODED and NOT-CODED). Details of how the filtering operations performed on a boundary between image blocks are modified according to the block types (encoding methods) of the blocks on either side of the boundary are provided, for example, on page 7, lines 18 to 38 and page 10, line 13 to page 11, line 13 (see especially Table 1 on page 11).

It should be appreciated that Kim does not teach, nor does it provide any suggestion, that an encoding method used to encode an image block can be taken into account when performing filtering operations intended to reduce blocking artefacts. In fact, it provides no discussion of encoding methods at all. In Kim it is the level of pixel value differences within / between adjacent image blocks that determines the mode of operation of the deblocking filter, while in the present invention (for example according to claims 1 or 19) it is the encoding methods

used to encode image blocks on a first and a second side of the block boundary that determine how the filtering is performed.

It should be appreciated that there is, in general, no fixed relationship between the level of pixel value differences within / between adjacent blocks and the encoding methods chosen to encode the image blocks. This means that according to Kim, adjacent image blocks that are found to belong to a smooth region of the image e.g. by applying the mode decision expression presented on page 12, lines 7 & 8, will always be filtered using the DC offset mode regardless of the encoding method (e.g. INTRA, COPY, CODED or NOT-CODED) with which they are encoded. In contrast, applying the method according to the invention, the same image blocks with the very same pixel value variations would be subjected to different filtering operations in dependence at least in part on the encoding methods used in their encoding.

Since the block boundary filtering method disclosed in Kim operates in a manner that is independent of the encoding method(s) used encode the image blocks being filtered and the independent claims of the present application all recite a dependence of block filtering upon encoding method, it should be apparent that the teachings of Kim cannot possibly represent a novelty bar for the present invention.

At least for these reasons, Applicants respectfully submit that Kim does not anticipate independent claims 1, 19, 37-40, and 44-47, and dependent claims 2, 4-9, 11, 13-15, 20, 22-27, 29, 32, 33, 42, 43, 48-50, and 52-57.

5. Applicants respectfully submit that claims 1, 2, 4-9, 11, 13-15, 19, 20, 22-27, 29, 32, 33, 42-50, and 52-57 are not

anticipated by Kim et al. (Kim et al. "A Deblocking Filter With Two Separate Modes in Block-Based Video Coding", IEEE Transactions on Circuits and Systems for Video Technology, Vol. 9, no. 1, pp. 156-160, February 1999, the "Kim article").

Similar to Kim (GB 2329090), cited above, the Kim article fails to disclose or suggest the features of the independent claims recited above with respect to Kim.

The Kim article relates to the same block boundary filtering method as that covered by Kim (GB 2329090). For this reason, the same arguments as presented above also apply to the disclosure provided by the Kim article. Specifically, the filtering method presented by the Kim article selects a filtering mode to be applied to a block boundary based on an assessment of pixel value differences within / between adjacent image blocks. It does not depend in any way upon an encoding method or methods chosen for a particular block or blocks. It therefore cannot be a novelty bar for the invention claimed in the present application, since all the independent claims of the present application include a dependence upon encoding method.

Applicants would also like to point out that similar arguments relating to the Kim article were submitted when responding to the previous Official Action issued on this case (OA dated 12th March 2004). In his response to those arguments, presented in section 12 of the current Official Action, the Examiner states that in his opinion, Applicants concede that the filtering method disclosed in the Kim article is dependent upon the encoding mode for a flat region. Applicants respectfully disagree with the Examiner and expressly re-iterate that **the block boundary filtering method described in the Kim article is**

independent of the encoding mode chosen for an image block. As explained above, in the Kim article, adjacent image blocks that are found to belong to a smooth region of the image e.g. by applying the mode decision expression presented on page 12, lines 7 & 8, will always be filtered using the DC offset mode regardless of the encoding method (e.g. INTRA, COPY, CODED or NOT-CODED) with which they are encoded. In contrast, applying the method according to the invention, the same image blocks with the very same pixel value variations would be subjected to different filtering operations in dependence at least in part on the encoding methods used in their encoding. As the block boundary filtering method disclosed in the Kim article operates in a manner that is independent of the encoding method(s) used encode the image blocks being filtered and the independent claims of the present application all recite a dependence of block filtering upon encoding method, the block boundary filtering method disclosed in the Kim article cannot be a novelty bar for the present invention as maintained by the Examiner.

At least for these reasons, Applicants respectfully submit that independent claims 1, 19, 37-40, and 44-47, and dependent claims 2, 4-9, 11, 13-15, 20, 22-27, 29, 32, 33, 42, 43, 48-50, and 52-57 are not anticipated by the Kim article.

6. Applicants respectfully submit that claims 1, 2, 4-9, 11, 13-15, 19, 20, 22-27, 29, 32, 33, 42-50, and 52-57 are not anticipated by Itoh (US 6,608,865).

Itoh fails to disclose or suggest the features of the independent claims as explained below.

Itoh discloses a method of block-based video coding in which the coding efficiency of DCT transform coefficients is improved by taking into account directionality information within image blocks. As explained between column 3, lines 1 and 64 (and as well-known to the skilled person in video coding), a conventional block-based video encoder applies a discrete cosine transform (DCT) to an image block, thereby transforming a block of pixel values into a matrix of horizontal and vertical spatial frequency components known as DCT coefficients (column 3, lines 3 to 20). It is also well-known that most energy is concentrated in the low frequency components i.e. those DCT coefficients grouped near the upper left-hand corner of the matrix have the largest values (see Figure 2). Taking this fact into account, the DCT coefficients are quantized using an array of quantization values (see Figure 3) such that higher frequency components tend to be quantised to zero (column 3, lines 49 to 55). It is acceptable to do this since the human visual system is less sensitive to high spatial frequencies than it is to lower frequencies.

The DCT coefficients are then scanned in rising order of spatial frequency (so-called zig-zag scanning) to produce an ordered sequence of coefficients. The ordered sequence is then coded using a statistical coding method, for example variable-length coding (VLC) (column 3, lines 55 to 64 and column 4, lines 22 to 48). Ordering of the DCT coefficients in ascending order of spatial frequency has the effect that the higher frequency DCT components, which tend to have zero values, become grouped together at the end of the order sequence. This means that a significant coding gain can be achieved when variable length coding is applied.

The coding method introduced by Itoh proposes altering the zig-zag scanning order of the DCT coefficients to take into account directionality within image blocks e.g. due to the presence of edges within an image. As explained in column 4, between lines 4 and 16, the direction of an edge within an image block has a high correlation with the corresponding DCT coefficients in the DCT coefficient matrix. For example, it is well known that when an image block contains a vertical edge, corresponding DCT coefficients with relatively large magnitude appear in the horizontal direction. This situation is illustrated in Figure 4 (type B edge), as are the distributions of DCT coefficients for horizontal (type A) and diagonal (type C) edges.

In more detail, the coding method proposed in Itoh, works by extracting edge information from an image block (column 5, lines 32 to 50), classifying the block into one of a number of directionality classes according to the directionality of the identified edge (column 5, line 51 to column 6, line 2) and then scanning the DCT coefficients of the block in manner that is related to the classification of the block (column 6, lines 8 to 10). The effect of this adaptive scanning procedure is to produce a shorter scanning path, which leads in turn to improved data compression when statistical coding (e.g. variable-length coding) is applied (column 4, lines 59 to 67).

As explained above, the coding method presented in Itoh is directed towards improving the coding gain of variable length coding applied to DCT coefficients by adapting the scanning order of the DCT coefficients.

It should be emphasised that the method of Itoh **does not** relate to a method for reducing visual artefacts due to a block

boundary between image blocks, as claimed in the present application. Furthermore, the method of Itoh **does not** comprise performing a filtering operation on the block boundary, as claimed in the present application, but instead concerns changing the scanning order of DCT coefficients. In fact Itoh does not relate to any form of filtering operation. This would be readily apparent to a skilled person in video coding.

Moreover, the adaptation of the DCT coefficient scanning order described in Itoh **is not** dependent upon an encoding mode of an image block, but rather upon a distribution of DCT magnitudes in a DCT transform matrix representative of an image block. It would therefore be incorrect to equate such an adaptation of the DCT coefficient scanning order with the dependency of the block boundary filtering operation on the encoding methods of image blocks on a first and a second side of a block boundary as claimed in the present application. Indeed, it should also be appreciated that the edges referred to in Itoh **are not** boundaries between image blocks, introduced because of the essentially "artificial" division of the image into blocks for coding purposes, but real features of the image that occur within image blocks. Thus, it would also be incorrect to equate the edges referred to in Itoh with the boundary between image blocks referred to in the claims of the present application.

For all of the above reasons, it is the Applicant's view that the coding method presented in Itoh cannot in any way be considered as a novelty bar for the invention claimed in the present application and respectfully requests the Examiner to reconsider his claim rejections based on this document.

Therefore, Applicants respectfully submit that Itoh does not anticipate independent claims 1, 19, 37-40, and 44-47, and dependent claims 2, 4-9, 11, 13-15, 20, 22-27, 29, 32, 33, 42, 43, 48-50, and 52-57.

7. Applicants respectfully submit that claims 41 and 51 are patentable over the Kim article.

Claims 41 and 51 depend from claims 1 and 46, respectively. For all the reasons argued with respect to the Kim article above, Applicants respectfully submit that the Kim article fails to disclose or suggest all the features of claims 1 and 46 and therefore does not render claims 41 and 45 unpatentable.

8. Applicants respectfully submit that claims 41 and 51 are patentable over Kim (GB 2329090).

As mentioned above, claims 41 and 51 depend from claims 1 and 46, respectively. Therefore, the reasons argued in support of claims 1 and 46 with respect to Kim are also applicable here. Thus, Applicants respectfully submit that Kim does not disclose or suggest all the features of claims 1 and 46 and therefore does not render claims 41 and 45 unpatentable.

9. Applicants respectfully submit that claims 41 and 51 are patentable over Itoh.

As mentioned above, Itoh, like the other cited references, fails to teach disclose or suggest all the features of claims 1 and 46 from which claims 41 and 51 depend. For this reason, claims 41 and 45 are patentable over Itoh.

For all of the foregoing reasons, it is respectfully submitted that all of the claims now present in the application are

clearly novel and patentable over the prior art of record, and are in proper form for allowance. Accordingly, favorable reconsideration and allowance is respectfully requested. Should any unresolved issues remain, the Examiner is invited to call Applicants' attorney at the telephone number indicated below.

A check in the amount of $1,020.00 is enclosed for a 3 month extension of time.

The Commissioner is hereby authorized to charge payment for any fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,

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